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"Deception Detection in Expert Source Information Through Bayesian Knowledge-Bases"

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6. AUTHOR(S)
Eugene Santos Jr.

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
University of Connecticut (now Dartmouth College)

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
AFOSR Air Force Office of Scientific Research
875 North Randolph Street
Suite 325, Room 3112
Arlington, VA 22203
Dr. Robert Herklotz

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13. ABSTRACT *(Maximum 200 words)*

Our goal in this effort is to automatically detect deception by an individual or expert who is contributing to an information knowledge-base consisting of multiple experts. Contemporary decision makers often must choose a course of action using knowledge from several sources. Knowledge may be provided from many diverse sources including electronic sources such as knowledge-based diagnostic or decision support systems, through data mining teclmiques, and so forth. As a decision maker's sources become more numerous, detecting deceptive information from these sources becomes vital to making a correct, or at least more informed, decision. This applies to unintentional misinformation as well as intentional disinfonnation. We are developing formal definitions for a deception attempt, the deception core, effective deception and successful deception. A deception attempt occurs when the opinions returned to a decision maker by an expert agent are not those calculated by that expert agent with the given observations but are substituted to influence the decision maker's actions. The deception core refers to those opinions which are manipulated to form a deception attempt. An effective deception is a deception attempt which succeeds in altering the actions of the decision maker, though not necessarily to the actions desired by the deceptive expert. Finally, a successful deception is an effective deception in which the alternate actions which the decision maker chooses are those desired by the deceptive expert. Our ongoing research focuses on employing models of deception and deception detection from the fields of psychology, cognitive science and artificial intelligence as well as implementing deception detection algorithms in probabilistic, intelligent, multi-agent systems.

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AFOSR Project Final Report FY 05

Project Title: Deception Detection in Expert Source Information Through Bayesian Knowledge-Bases
PI: Eugene Santos Jr., University of Connecticut (now Dartmouth College)
AFOSR Grant No. F49620-03-1-0014
AFOSR PM: Dr. Robert Herklotz

Project Summary

Our goal in this effort is to automatically detect deception by an individual or expert who is contributing to an information knowledge-base consisting of multiple experts. Contemporary decision makers often must choose a course of action using knowledge from several sources. Knowledge may be provided from many diverse sources including electronic sources such as knowledge-based diagnostic or decision support systems, through data mining techniques, and so forth. As a decision maker's sources become more numerous, detecting deceptive information from these sources becomes vital to making a correct, or at least more informed, decision. This applies to unintentional misinformation as well as intentional disinformation. We are developing formal definitions for a deception attempt, the deception core, effective deception and successful deception. A deception attempt occurs when the opinions returned to a decision maker by an expert agent are not those calculated by that expert agent with the given observations but are substituted to influence the decision maker's actions. The deception core refers to those opinions which are manipulated to form a deception attempt. An effective deception is a deception attempt which succeeds in altering the actions of the decision maker, though not necessarily to the actions desired by the deceptive expert. Finally, a successful deception is an effective deception in which the alternate actions which the decision maker chooses are those desired by the deceptive expert. Our ongoing research focuses on employing models of deception and deception detection from the fields of psychology, cognitive science and artificial intelligence as well as implementing deception detection algorithms in probabilistic, intelligent, multi-agent systems

Major Accomplishments FY 05

- We expanded our framework to explore deception detection in all-source intelligence analysis processes.
- We developed a new algorithm and theoretical framework that supports sensitivity analysis and validation of Bayesian knowledge-bases central to deception detection.

Publications in FY 05

[The publications below were supported in full or in part by this project.]

Santos, Eugene, Jr., Zhao, Qunhua, Johnson, Gregory, Nguyen, Hien, and Thompson, Paul, "A Cognitive Framework For Information Gathering with Deception Detection For

Intelligence Analysis," *Proceedings of the 2005 International Conference on Intelligence Analysis*, McClean, VA, 2005.

Thompson, Paul, Santos, Eugene, Jr., Zhao, Qunhua, Johnson, Gregory, and Nguyen, Hien, "Counter Denial and Deception and Utility-Theoretic Information Retrieval for Intelligence Analysis," *Proceedings of the 2005 International Conference on Intelligence Analysis*, McClean, VA, 2005.

Santos, Eugene, Jr. and Dinh, Hang T., "Consistency of Test Cases in Validation of Bayesian Knowledge Bases," *Proceedings of the 16th IEEE International Conference on Tools with Artificial Intelligence (ICTAI 2004)*, 468-475, Boca Raton, FL, 2004.

Personnel Supported in FY 05

Dr. Eugene Santos Jr.
Hang Dinh (graduate student)

Interactions & Transitions in FY 05

Invited Participant, AFOSR Workshop on Decision Making in Adversarial Domains, Greenbelt, MD, May 2005.

On Modeling User and Adversarial Intent for Prediction and Explanation, Invited Speaker, Advanced Technology Laboratories, Lockheed Martin, Cherry Hill, NJ, 2004.

AIR FORCE OFFICE OF SCIENTIFIC RESEARCH

DTIC Data

Purchase Request Number: FQ8671-0201496

BPN:

Proposal Number: 02-NM-184

Type Submission: New Work Effort

Inst. Control Number: F49620-03-1-0014DEF

Institution: UNIV OF CONNECTICUT

Primary Investigator: Professor Eugene Santos, Jr.

Invention Ind: none

Project/Task: 2304F / X

Program Manager: Dr. Robert L. Herklotz

Objective:

The goal of the research is to automatically detect deception by an individual or expert who is contributing to an information knowledge-base consisting of multiple experts.

Approach:

The approach includes the following:

1) Extend and analyze Bayesian knowledge-bases for capturing multi-expert information under uncertainty

2) Develop framework for categorizing and classifying errors hat may be committed by an expert

3) Design algorithms for automatic deception detection cpable of providing detailed evidential information in support of said deception plus analysis of the impact of the deception

4) Evaluate the effectiveness of this approachby developing a prototype system

Progress:

Year: 2004 **Month:** 07

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Project Summary

With the increased acceptance of knowledge-based intelligent systems for diagnosis and decision support, the dependence of human decision makers upon such systems has increased as well. As we become more dependent upon these systems the impact of deceptive information offered by these systems becomes impossible to ignore. Our goal in this proposal is to automatically detect deception from a given expert source with a longer term goal to address the even more difficult problem of deception detection in the face of multiple expert collusion.

Major Accomplishments FY 03

We have developed an initial model of deception which not only attempts to detect deception but identifies the deception tactic as well as the goal of the deception The first step in this model of deception detection is the detection of unexpected results/anomalies or detenmntng whether some piece of information is suspect.

DTIC Data

Progress:

Year: 2004 **Month:** 10

ANNUAL REPORT FOR: F49620-03-1-0014

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Year: 2005 **Month:** 09 **Final**

Final Report for: F49620-03-1-0014

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